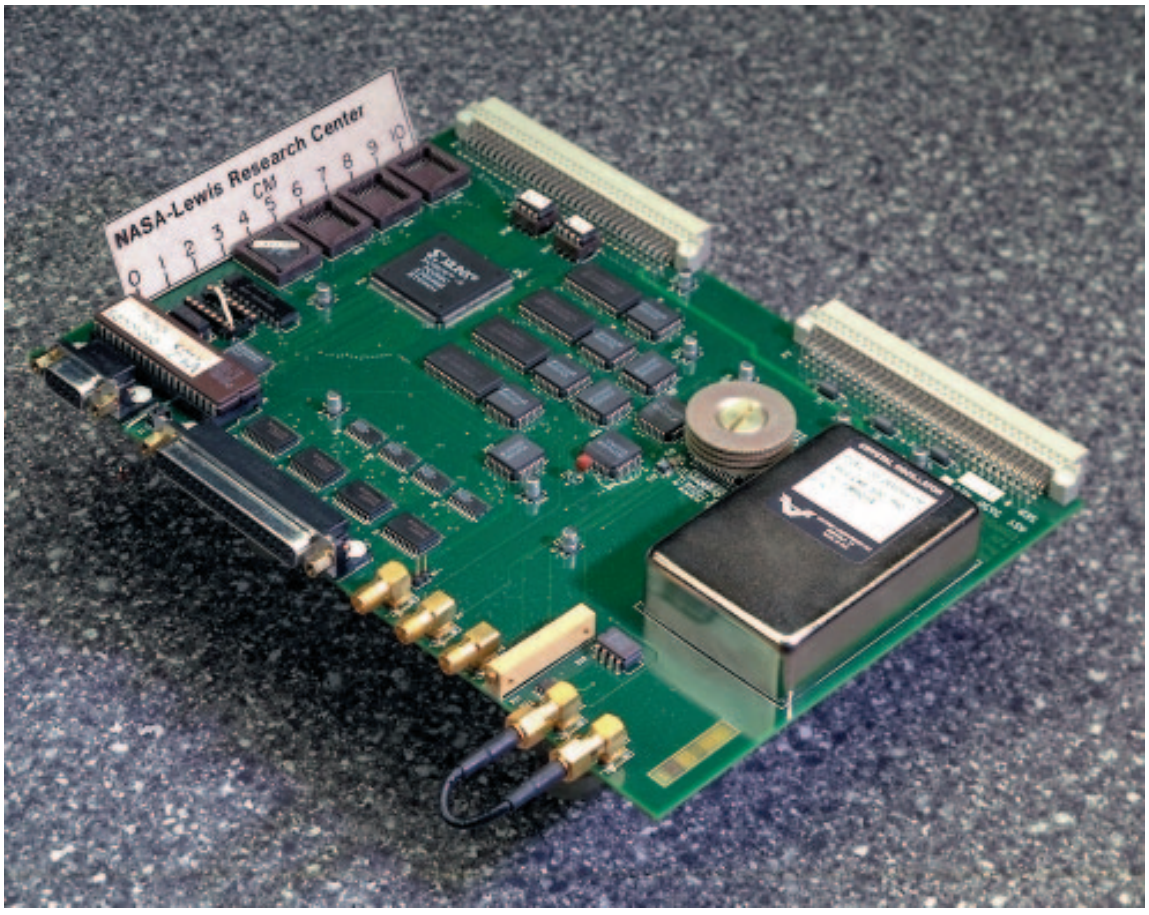
Technology Opportunity

Low-Complexity, Digital Encoder and Modulator

The National Aeronautics and Space Administration (NASA) Lewis Research Center seeks to transfer the technology for a low-complexity, flexible digital encoder and modulator (DEM) for medium- to high-data-rate radio frequency communication links.

Potential Commercial Uses

- Terrestrial wireless communication
- High-data-rate links for commercial communications and remote sensing



Digital encoder and modulator (DEM) hardware.

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- High-data-rate downlinks to ground terminals or direct data downlinks from near-Earth science platforms

Benefits

- Bandwidth and power efficient
- Programmable modulation techniques
- Very high data rate
- Very low cost compared with conventional analog alternatives
- Small size and mass

The Technology

NASA Lewis has developed a low-complexity, flexible Digital Encoder and Modulator (DEM) for medium- to high-data-rate radio frequency communication links. The baseline DEM configuration supports the B-ISDN OC-3 rate of 155.52 megabits per second (Mbps) in 80 MHz of null-to-null bandwidth. Test results show less than 0.2 dB of degradation from theory in the range of operation. This is achieved through the use of advanced modulation and coding technology which results in a bandwidth- and power-efficient solution for wireless communications transceivers.

Also, the DEM uses low-complexity Digital Signal Processing (DSP) techniques to perform the high-speed encoding, pulse shaping, and upconversion necessary for an efficient implementation. For example, high-speed filtering and precompensation are performed via a Field Programmable Gate Array (FPGA) and programmable lookup tables using static RAM. This implementation avoids the requirement for the very fast Finite Impulse Response (FIR) filters that at high data rates are very inefficient in terms of power consumption. The additional benefit is the ability to easily implement many different modulation techniques and bandwidth constraints by reprogramming the filter lookup table.

Options for Commercialization

To further refine the DEM technology, SICOM, Inc, and NASA Lewis are collaborating on the design and development of a chip-level bandwidth- and power-efficient digital modem. Under a Small Business Innovation Research (SBIR) phase II contract, SICOM is developing a low-cost, Rapid Acquisition Digital Data (RADD) modem for two-way wireless communications. The digital chip set implementation makes the RADD modem much lower in cost and higher in performance than conventional analog alternatives. The RADD modems will use Lewis–developed pragmatic concatenated codes and DSP techniques. The overall result is the transmission of high-speed data at service levels that equal or exceed those of fiber-based communications. NASA Lewis also offers related signal processing and communications technology applicable to a wide range of digital systems.

Contact

Nam Nguyen
Digital Communications Technology Branch
NASA Lewis Research Center
Mail Stop 54-8
21000 Brookpark Road
Cleveland, OH 44135
Phone: (216) 433-3425
E-mail: nnguyen@lerc.nasa.gov

Key Words

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